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On some aspects of Neandertal zygomatic morphology



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ABSTRACT

Neandertals are characterized by a series of well-documented facial characteristics, including midfacial prognathism, large nasal and orbital areas, and a marked supraorbital torus. We provide a comparative morphometric study of another part of this facial complex, the frontal process of the zygomatic. We find that European Neandertals have a distinctly columnar form of the frontal process not found in recent modern humans and most Pleistocene modern humans. Some purportedly modern specimens and specimens pre-dating Neandertals exhibit the same pattern as European Neandertals, while others exhibit the modern human pattern. The columnar form is likely a retention of the ancestral state in Neandertals and the other late Pleistocene specimens that exhibit it, but variation in the pattern seen in early modern humans reveals possible insights into late Pleistocene human evolution.

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Introduction

Neandertal morphology has been a subject of detailed studies ever since the first specimen belonging to this group was recognized in 1856. Many of the differences noted between Neandertals and anatomically more modern groups have concentrated on cranial traits (see discussion in [Cartmill and](#)

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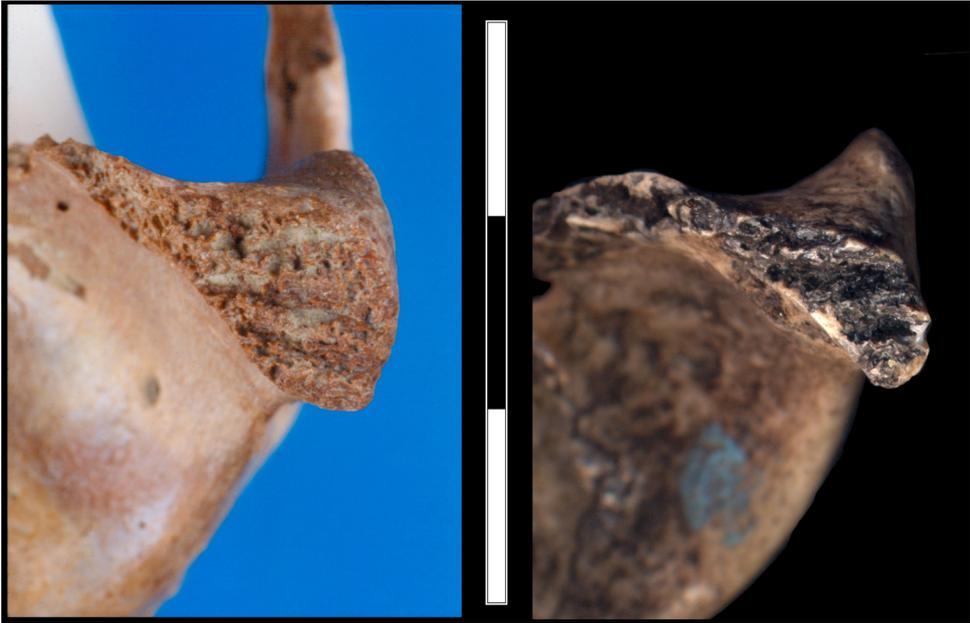


Fig. 1. Superior view of NN34 (left) and modern human zygomatic bone (right). Scale is 30 mm.

Smith, 2009). Of these, some of the most interesting are seen in the Neandertal lateral and midfacial region. In this paper we concentrate on certain aspects of zygomatic morphology. This region in Neandertals has previously been reported to differ from anatomically modern humans, especially in the morphology of the frontal process, which in Neandertals has been described as thick and pillar-like (Smith, 1983, 1992; Smith and Ranyard, 1980; Walker et al., 2011). In recent humans, the area of the zygomatic bone contact surface with the frontal bone is relatively small, and distinct orbital and facial plates can be seen on the zygomatic's frontal process (Fig. 1). In Neandertals these plates are not as distinct (Fig. 1) as a result of the expansion of this contact surface and of the region between the plates, forming a columnar, or pillar-like, orbital margin (Smith, 1992). We undertake a comparative morphometric study of the Neandertal zygomatic bone morphology, in particular the size and the shape of the frontal process. The aim of our study is to test the null hypothesis that Neandertals and anatomically modern humans do not differ in quantitative aspects of this region. We also review evidence of additional morphological zygomatic differences across these samples. Furthermore, we compare Neandertal and anatomically modern human samples to several Middle and Late Pleistocene specimens in order to assess whether the "Neandertal pattern" is present in humans that represent earlier stages in, or are generally not considered to belong to, the Neandertal lineage. In addition, we have compared the European Neandertal sample to two Shanidar Neandertals, in order to see whether the zygomatic morphology of these Western Asian specimens follows the same pattern as the European specimens.

Materials and methods

The Neandertal sample used for metric observations in this analysis consists of the zygomatic bone (NN34) from the original Kleine Feldhofer Grotte in the Neander valley, Germany, the Vi 307 (aka. Vi 11.6, Ahern et al., 2004) zygomatic from the Vindija Cave, Croatia, four relatively complete zygomatics from Krapina, Croatia (40.1, 40.2, 40.3, and the zygomatic associated with Krapina 3) and zygomatics

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